

WHAT WE CLAIM IS:

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1. An apparatus for performing biological reactions, comprising:

- (a) a substrate having a first surface and a second surface opposite thereto;
(b) a multiplicity of biomolecules positioned on the first surface of the

5 substrate;

(c) a flexible layer affixed to the first surface of the substrate by an adhesive layer, wherein the adhesive layer is deposited on the first surface of the substrate and encloses an area thereupon, and wherein a volume is enclosed between the flexible layer and the first substrate surface in the area defined by the adhesive layer; and

(d) first and second ports extending through the flexible layer and the adhesive layer into the volume enclosed between the flexible layer and the first substrate surface in the area defined by the adhesive layer.

2. The apparatus of Claim 1 wherein the substrate is made of glass, silicon, ceramic

15 or plastic.

3. The apparatus of Claim 1 wherein each of the multiplicity of biomolecules is attached to an anchoring structure.

4. The apparatus of Claim 3 wherein the anchoring structure comprises a gel pad.

5. The apparatus of Claim 4 wherein the gel pad is a polymeric gel pad.

The apparatus of claim 5 wherein the gel pad is a polyacrylamide gel pad.

7 6. The apparatus of Claim 3 wherein the anchoring structure comprises a continuous layer of polyacrylamide gel.

8 7. The apparatus of Claim 1 wherein the multiplicity of biomolecules comprises an ordered array of biomolecules.

9 8. The apparatus of Claim 1 wherein the flexible layer is made of plastic, rubber, polyester, or Teflon.

10 9. The apparatus of Claim 8 wherein the flexible layer is made of polypropylene, polyethylene or polyvinylidene chloride.

11 10. The apparatus of Claim 1 wherein the flexible layer is a translucent plastic.

12 11. The apparatus of Claim 1 wherein the flexible layer is a gas permeable membrane.

13 12. The apparatus of Claim 1 further comprising a water-soluble compound that is a solid at room temperature and a liquid at a second, higher temperature, wherein the water-soluble compound fills the volume enclosed between the flexible layer and the first substrate surface in the area defined by the adhesive layer.

14 13. The apparatus of Claim 12 wherein the water-soluble compound is polyethylene glycol.

15 14. The apparatus of Claim ¹⁴13 wherein the water-soluble compound is polyethylene glycol 600.

5 16 15. The apparatus of Claim 1 further comprising a label layer affixed to the flexible layer, wherein the first and second ports extend through the label layer and the flexible layer.

10 17 16. The apparatus of Claim ¹⁶15 wherein the label layer comprises an adhesive surface and a non-adhesive surface, and wherein the label layer is affixed to the flexible layer using the adhesive surface.

15 18 17. The apparatus of Claim ¹⁶15 wherein the label layer comprises a window corresponding in size and position to the area bounded by the adhesive layer, and wherein the window allows visual inspection of the flexible layer and the volume enclosed between the flexible layer and the first substrate surface in the area defined by the adhesive layer.

19 18. The apparatus of Claim 1 further comprising a reflective layer positioned between the array and the first substrate surface.

20 20 19. The apparatus of Claim 1 further comprising a resistive heater.

21 20. The apparatus of Claim 1 wherein the resistive heater comprises a reflective layer positioned between the array and the first substrate surface.

22 ~~21~~ The apparatus of Claim 1 further comprising a passivation layer.

23 ~~22~~ The apparatus of Claim ~~21~~²² wherein the passivation layer is made of parylene.

24 ~~23~~ The apparatus of Claim 1 further comprising a scanner, wherein the scanner is in contact with the flexible layer at a position over the array.

25 ~~24~~ The apparatus of Claim ~~12~~¹³, wherein the scanner is a light pipe and covers the entirety of the area bounded by the adhesive and comprising the array.

26 ~~25~~ The apparatus of Claim ~~12~~¹³, wherein the scanner is a movable scanner and moves longitudinally across the area bounded by the adhesive and comprising the array.

27 ~~26~~ The apparatus of Claim 1 further comprising a sample preparation chip in contact with the second substrate surface, wherein the sample preparation chip has a port that is aligned with the first port of the apparatus.

28 ~~27~~ The apparatus of Claim 1 further comprising a roller, wherein the roller is in contact with the flexible layer at a position over the array.

29 ~~28~~ The apparatus of Claim ~~16~~¹⁷, wherein the roller moves longitudinally across the area bounded by the adhesive and comprising the array.

20 29. The apparatus of Claim 1 further comprising:

(a) a case having a lid and a base,

(b) a cavity disposed in the base, and

5 (c) a carriage comprising a scanner and a roller, wherein the carriage is provided in the cavity, wherein the substrate is removably positioned above the carriage such that the first substrate surface is in operative contact with the carriage.

31 30. The apparatus of Claim 29 wherein the lid further comprises a display unit.

10 32 31. The apparatus of Claim 29 wherein the carriage further comprises a pivot point provided between the scanner and the roller.

15 33 32. The apparatus of Claim 31 and wherein the motion of the carriage about the pivot point is controlled by a solenoid.

34 33. An apparatus for performing biological reactions, comprising:

(a) a glass microscope slide having a first surface and a second surface opposite thereto;

20 (b) a multiplicity of biomolecules positioned on the first surface of the slide, wherein each biomolecule is anchored to the first surface by a polyacrylamide gel;

(c) a layer of polyvinylidene chloride affixed to the first surface of the slide by a layer of double-sided adhesive, wherein the adhesive layer is deposited on the first surface

of the slide and encloses an area thereupon and wherein a volume is enclosed between the layer of polyvinylidene chloride and the surface of the glass slide in the area defined by the adhesive layer;

(d) a layer of a polyethylene glycol positioned between the first surface of the slide and the layer of polyvinylidene chloride;

(e) a reflective layer positioned between the array and the first substrate surface;

(f) a layer of parylene positioned between the reflective layer and the and the layer of polyvinylidene chloride; and

(g) a resistive heater.

35 34. An apparatus for performing biological reactions, comprising:

(a) a glass microscope slide having a first surface and a second surface opposite thereto,

(b) a multiplicity of biomolecules positioned on the first surface of the slide, wherein each biomolecule within the array is anchored to the first surface by a polyacrylamide gel ;

(c) a layer of polyvinylidene chloride affixed to the first surface of the slide by a layer of double-sided adhesive, wherein the adhesive layer is deposited on the first surface of the slide and encloses an area thereupon and wherein a volume is enclosed between the layer of polyvinylidene chloride and the first surface of the glass slide in the area defined by the adhesive layer;

(d) a first and second port extending through the layer of polyvinylidene chloride and through the layer of double-sided adhesive into the volume enclosed between the layer of polyvinylidene chloride and the first surface of the glass slide;

5 (e) a layer of a polyethylene glycol positioned between the first surface of the slide and the layer of polyvinylidene chloride;

(f) a reflective layer positioned between the array and the first substrate surface;

(g) a layer of parylene positioned between the reflective layer and the and the layer of polyvinylidene chloride;

10 (h) a resistive heater;

(i) a case having a lid and a base, wherein the lid further comprises a display unit;

(j) a cavity disposed in the base; and

15 (k) a carriage comprising a scanner and a roller, wherein the carriage is provided in the cavity, and wherein the slide is removably positioned above the carriage such that the first slide surface is in operative contact with the carriage.

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